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ORIGINAL ARTICLE

Relation between Central Obesity and Severity of Coronary Artery Disease in Patients Undergoing Coronary Angiography

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ABSTRACT

Background: Central obesity and increasing BMI raise the risk of metabolic syndrome, type 2 diabetes, and dyslipidemia. The waist circumference is a more accurate measure than BMI for predicting the severity of coronary artery disease. Thus, our objective was to predict severity of coronary artery disease assessed by coronary angiography (Syntax Score) in patients with central obesity whether fulfilling the criteria for metabolic syndrome or not.

Methods: This cross-sectional study included 100 obese patients' with symptoms of coronary artery disease (CAD) whose coronary angiography was performed. Each patient's waist circumference (WC) and body mass index (BMI) were determined independently. The SYNTAX Score was used to determine the severity and complexity of CAD.

Results: Our study found that body mass index (BMI) correlates with high levels of fasting blood glucose (FBG), cholesterol, triglycerides, low density lipoproteins (LDL) and low levels of high density lipoproteins (HDL). Waist circumference (central obesity) correlates with triglycerides and Syntax Score (severity of CAD). Waist circumference that is ≥ 130 cm has highest sensitivity (85.71%) and specificity (82.56%) to detect high Syntax Score. Metabolic syndrome (Mets) is associated with high levels of FBG, cholesterol, triglycerides and low levels of HDL. Also, Mets is associated with high Syntax Score (severity of CAD).

Conclusion: There is a statistically significant relation between syntax score grades and waist circumference.

Keywords: Central; Obesity; Syntax; Coronary; Angiography

INTRODUCTION

Around 7 million deaths and 129 million Disability Adjusted Life Years (DALYs) are caused by coronary artery disease (CAD) each year, making it the leading cause of death and DALYs worldwide. Numerous studies that have attempted to identify and manage these factors have found that central obesity and its role in metabolic syndrome are risk factors for CAD [1].

Globally, obesity is becoming a more serious health issue. More than 80% of CAD patients are obese or overweight. An independent risk factor for the onset of CAD is obesity [2].

Weight loss is a generally beneficial risk-factor intervention because it may stop the advancement of atherosclerosis or the occurrence of acute coronary syndrome events, even though obesity is frequently regarded as a relatively "minor" CAD risk factor [3].

Body mass index (BMI) is one of the most often used measures for evaluating obesity, however it may not accurately reflect the degree of regional adiposity. Waist circumference, a clear sign of abdominal obesity, has been shown to is a more accurate indicator of coronary artery disease than total obesity [4].

The "metabolic syndrome" includes abdominal fat because it is associated with diseases like hypertension, diabetes mellitus, and dyslipidemia, which accelerate the artery-blocking process caused by atherosclerosis and increase the risk of cardiovascular disease [5].

Because they are believed to be associated with a higher risk of a number of illnesses, including as hypertension (HTN), coronary artery disease (CAD), heart failure, and type 2 diabetes, overweight and obesity are becoming more prevalent worldwide [6]. Waist circumference (WC), waist-to-height ratio (WHtR), and waist-to-hip ratio (WHR) are measurements of abdominal obesity that, according to recent research, offer a more precise way to distinguish between BMI and the cardiac risk linked to obesity [7].

If a person exhibits three or more of the following symptoms—high blood pressure, a large waist circumference, low HDL cholesterol, high triglycerides, and high blood glucose—they are diagnosed with metabolic syndrome [8].

Chronic inflammation brought on by obesity plays a role in atherosclerosis. Increased levels of inflammatory adipokines in visceral obesity lead to endothelial dysfunction, hypercoagulability, and insulin resistance—all of which contribute to the atherosclerotic process and raise the risk of myocardial infarction [9].

Through atrial enlargement, ventricular enlargement, and atherosclerosis, an increase in body fat can directly cause heart disease. By promoting the development of metabolic diseases like dyslipidemia, hypertension, and type 2 diabetes as well as thromboembolic illness, body fat indirectly causes heart disease [10].

To evaluate CAD patients and forecast their outcomes after therapeutic intervention, various assessment techniques have been established. The SYNTAX score is among the most significant scoring schemes [11].

A visual representation of the complexity and load of CAD is the SYNTAX score. Bifurcations, chronic complete occlusions, thrombus, calcification, and minor diffuse disease are among the complex lesions that are considered [12].

Predicting the level of coronary artery disease in people with central obesity was the aim of this investigation, regardless of whether they fit the criteria for metabolic syndrome, based on coronary angiography (Syntax Score).

METHODS

One hundred obese Egyptian participants who had coronary artery disease symptoms and had coronary angiography were included in this study. From June 2023 to June 2024, this study was conducted at the Cardiology department of Zagazig University's Faculty of Medicine. Every participant who was involved provided their informed consent. The Faculty of Medicine's ethical committee approved the study, Zagazig University (IRB number 9730-28-8-2022).

Adult patients of both sexes who are overweight or obese and have coronary artery disease symptoms and have had coronary angiography performed are eligible to participate.

Refusing to sign a consent form is an exclusion criterion. Also, patients with a history of percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG) or those suffering from chronic renal disease are excluded from participation.

The record of each patient will include detailed information, with a focus on:

History taking: Age, gender, the existence of diabetes mellitus, hypertension, prior PCI, and current medical therapy were among the demographic, personal, and medical history data collected. Additionally, Information on lifestyle choices, including physical exercise and smoking, was gathered.

Clinical examination: After five minutes of rest, blood pressure was taken twice while seated. According to the guidelines, A diagnosis of hypertension should be made if a patient's systolic blood pressure (SBP) is greater than 140 mm Hg in the clinic or office, and/or his diastolic blood pressure (DBP), calculated by averaging two or more measurements taken at different times, is greater than 90 mm Hg [13].

If there is evidence of cardiovascular disease (CVD) and the blood pressure is ≥180/110 mm Hg, the diagnosis can be done in a single visit [14].

Laboratory tests: Blood samples were obtained following an overnight fast in order to determine the levels of fasting triglycerides (TG), HDL-C, LDL-C, total cholesterol, and fasting blood glucose (FBG). The National Program for Cholesterol Education (NCEP) Third Report defined dyslipidemia as any of the following after a 9–12 hour fast: HDL < 40 mg/dl, LDL > 130 mg%, and blood cholesterol ≥ 200 mg/dl [15]. Tests for renal function and CBC (complete blood count) were also performed.

Every subject had a 12-lead resting electrocardiogram (ECG). Every patient underwent transthoracic echocardiography to evaluate coronary artery disease by identifying any abnormalities in resting segmental wall motion and to measure left ventricular function by estimating the ejection fraction (EF) using the Simpson technique [16].

Measurements of waist circumference and body mass index show central obesity when the circumference is greater than 102 cm for men and 88 cm for women [17]. BMI, or body mass index: Overweight: 25.0-29.9; Obesity: 30.0 - and above; Underweight: less than 18.5; Normal: 18.5-24.9 [18].

Using a standard percutaneous technique, coronary angiography was carried out on each patient under local anesthesia via a radial or femoral artery route. The degree of CAD was assessed using the SYNTAX score. Software (http://www.syntaxscore.com/calc/start.htm) was used to generate the SYNTAX scores for each patient. Four categories of patients are distinguished based on their SYNTAX score (SS): (1) none CAD (SS=0); (2) low SS (SS 1–22); (3) intermediate SS (SS 23–32); and (4) high SS (SS>/= 33) [19].

In 2001, the Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program (NCEP) established the definition of metabolic syndrome (MetS) and associated diagnostic standards. This categorization was modified in 2005 by the National Heart Lung and Blood Institute and the American Heart Association [20]. According to the NCEP ATP III definition, the metabolic syndrome is present if three or more of the five criteria listed below are satisfied:

(WC ≥ 88 cm for women and ≥ 102 cm for men) is needed to diagnose obesity in the center.

High triglyceride levels: more than 150 mg/dl (1.7 mmol/l) necessitate special therapy for hypertriglyceridemia.

Treatments for dyslipidemia or low HDL-C levels: less than 40 mg/dl (1.0 mmol/l) in men and less than 50 mg/dl (1.3 mmol/l) in women.

Having a systolic blood pressure of 130 or a diastolic blood pressure of 85 mmHg, or taking medication for hypertension, is considered hypertension.

Increased levels of blood sugar. having diabetes mellitus medication or a fasting blood glucose level more than 100 mg/dl.

Statistical analysis

A computer program called IBM SPSS 23.0 for Windows (SPSS Inc., Chicago, IL, USA) was used to code, enter, and analyze the gathered data. ANOVA, Kruskal-Wallis test, Mann-Whitney test, The ROC curve (receiver operating characteristic), Pearson's and Spearman rank correlation coefficient, independent sample t-test, chi-square test, and Fisher exact test were all used.

RESULTS

This cross-sectional study comprised one hundred patients with coronary angiography and symptoms of coronary artery disease. Their mean ± SD was 56.3 ± 8.33, and their ages varied from 42 to 72 years. Of them, 27% were men and 73% were women. Their mean ± SD was 34.8 ± 3.45, and their BMI varied from 29 to 45 kg/m2. Their mean ± SD was 124.5 ± 7.11, and their waist circumference varied between 110 and 140 cm. Additionally, 68 percent of the patients had metabolic syndrome, 61 percent had diabetes, 35 percent had dyslipidemia, and 88 percent had hypertension. (Table 1)

The median BMI was greater among patients with metabolic syndrome, indicating a correlation that is statistically significant between the two (P=0.02). Additionally, there was a statistically significant correlation between BMI and dyslipidemia, with the median BMI of individuals with dyslipidemia being greater (P=0.01). (Table 2) The median syntax score was higher for male patients (P<0.001), demonstrating a statistically significant correlation between syntax score and sex. Furthermore, the syntax score and clinical data showed a statistically significant association, with the median score for individuals with metabolic syndrome, diabetes, hypertension, and dyslipidemia being higher (P<0.001). (Table 3)

The median waist circumference was higher among individuals with higher syntax scores (P=0.02), suggesting that the two variables have a statistically significant link. Additionally, there was a statistically significant correlation between metabolic syndrome and syntax score grades; all patients (100%) with higher syntax scores had metabolic syndrome, compared to 53.8% of patients with lower syntax scores (P<0.001). (Table 4)

The median (IQR) for the syntax score was 5 (10), with a range of 0 to 33. Additionally, 78 percent of the patients had low syntax scores, 8 percent had intermediate scores, and 14 percent had high scores. (Table 5)

Regarding the number of vessels implicated, 12 percent of patients had two vessels involved, 26 percent had one vessel involved, and 17 percent of patients had three or more vessels affected. Forty-five percent of patients had no vessels involved. Regarding the names of the stenosed arteries implicated, the LAD artery was involved in 46% of the patients, the diagonal artery in 10%, the LCX artery in 20%, the OM artery in 8%, the RCA in 20%, and the left major artery in 2% of the patients. (Table 6) The difference between metabolic and non-metabolic obese patients was statistically significant; the non-metabolic obese patients had higher HDL levels (P<0.001), while the metabolic obese patients had higher fasting blood glucose, triglycerides, cholesterol, and syntax score (P<0.001). Additionally, hypertension was seen in all metabolic obese individuals (100%) compared to non-metabolic obese patients (68.4%). Additionally, there was a statistically significant difference in the number of vessels involved between individuals who were metabolically obese and those who were not; 63.2 percent of the former had no arteries involved, compared to 33.9 percent of the latter (P=0.004). Additionally, compared to 7.9% of the non-metabolic obese individuals, 22.6% of the metabolic obese patients had three or more affected vessels (P=0.02). (Table 7)

While there was a significant negative association with HDL (r=-0.286, P=0.004), there was a substantial positive correlation with BMI and waist circumference (r=0.393, P<0.001), FBG (r=0.293, P=0.003), cholesterol (r=0.285, P=0.004), triglycerides (r=0.343, P<0.001), and LDL (r=0.306, P=0.002). Additionally, there was a strong positive association between the syntax score (r=0.296, P=0.003) and waist circumference and triglycerides (r=0.347, P<0.001). (Table 8)

When ROC (Receiver Operation Curve) analysis was performed to identify the best cutoff value for identifying high syntax scores, it revealed that BMI had the maximum sensitivity (64.29%) and specificity (44.02%) at 34, with an area under the curve of 0.581. Additionally, measuring waist circumference using ROC analysis revealed that it had the maximum sensitivity (85.71%) and specificity (82.56%) at 130, with an area under the curve of 0.732. (Fig. 1)

Table 1: Demographic and clinical data among studied patients

Variables		**All patients (n=100)**
Age *(years)*	*Mean ± SD*	56.3 ± 8.33
	Range	(42 – 72)
Sex *(n. %)*	Female	73 (73%)

Variables		All patients (n=100)
	Male	27 (27%)
BMI *(Kg/m²)*	*Mean ± SD*	34.8 ± 3.45
	Range	(29 – 45)
Waist circumference *(cm)*	*Mean ± SD*	124.5 ± 7.11
	Range	(110 – 140)
Hypertension	No	12 (12%)
	Yes	88 (88%)
Diabetes mellitus	No	39 (39%)
	Yes	61 (61%)
Dyslipidemia	No	65 (65%)
	Yes	35 (35%)
Metabolic syndrome	No	38(38%)
	Yes	62(62%)

Table 2: Relation of BMI and clinical data among studied patients

Variables		**BMI** *(Kg/m²)* *Median IQR)*	P Value
Sex	Female	35 (4.3)	0.46
	Male	34.7 (2.8)	
Hypertension	No	35 (2.75)	0.21
	Yes	35 (4.3)	
Diabetes mellitus	No	35 (3.3)	0.84
	Yes	35 (4.3)	
Dyslipidemia	No	34 (5)	**0.01**
	Yes	35 (4)	
Metabolic syndrome	No	33.5 (4.38)	**0.02**
	Yes	35 (4)	

Table 3: Relation between syntax score and BMI and waist circumference among studied patients

Variables		Low (n=78)	Intermediate (n=8)	High (n=14)	P Value
BMI	*Median (IQR)*	34.5 (3.3)	37 (10)	35 (2.83)	0.13[1]
	Range	(29 – 41.5)	(29 – 45)	(31 – 39.2)	
Waist circumference	*Median (IQR)*	124 (10.25)	127 (4.5)	130.5 (12)	**0.02[1]**
	Range	(110 – 138)	(123 – 129)	(112 – 140)	
Metabolic syndrome	No	36 (46.2%)	2 (25%)	0 (0%)	**<0.001[2]**
	Yes	42 (53.8%)	6 (75%)	14 (100%)	

[1]Mann-Whitney U test, [2]Fisher exact test, Non-significant: P >0.05, Significant: P ≤0.05

Table 4: Syntax score classification among the studied patient

Variables		All patients (n=100)
Syntax score	*Median (IQR)*	5 (10)
	Range	(0 – 33)
Syntax score classification *(n. %)*	Low	78 (78%)
	Intermediate	8 (8%)
	High	14 (14%)

Table 5: Comparison between metabolic and non-metabolic obese

Variables		Metabolic (n=62)	Non-metabolic (n=38)	P Value
Cholesterol *(mg/dl)*	*Median (IQR)*	177 (38.5)	152 (40)	**<0.001**[1]
	Range	(122 – 276)	(122 – 189)	
Triglycerides *(mg/dl)*	*Median (IQR)*	176 (71.5)	125.5 (31)	**<0.001**[1]
	Range	(65 – 285)	(53 – 212)	
HDL *(mg/dl)*	*Median (IQR)*	40.5 (10)	53 (11)	**<0.001**[1]
	Range	(32 – 55)	(30 – 63)	
LDL *(mg/dl)*	*Median (IQR)*	97 (22.5)	90 (28.5)	0.09[1]
	Range	(62 – 193)	(72 – 111)	
FBG *(mg/dl)*	*Median (IQR)*	142.5 (54.3)	99 (4)	**<0.001**[1]
	Range	(100 – 392)	(80 – 187)	
Syntax score	*Median (IQR)*	8 (13)	0 (3)	**<0.001**[1]
	Range	(0 – 33)	(0 – 21)	
Number of vessels involved	Zero	21 (33.9%)	24 (63.2%)	**0.004**[3]
	One	17 (27.4%)	9 (23.7%)	0.68[3]
	Two	10 (16.1%)	2 (5.3%)	0.13[2]
	Three or more	14 (22.6%)	3 (7.9%)	0.06[2]
Name of stenosed arteries	LAD	34 (54.8%)	12 (31.6%)	**0.02**[3]
	Diagonal	10 (16.1%)	0 (0%)	**0.01**[2]
	LCX	18 (29%)	2 (5.3%)	**0.004**[2]
	OM	7 (11.3%)	1 (2.6%)	0.15[2]
	RCA	15 (24.2%)	5 (13.2%)	0.21[2]
	Left main	1 (1.6%)	1 (2.6%)	1.00[2]

*[1]*Mann-Whitney U test,* [2]*Fisher exact test,* [3]*Chi-square test, Non-significant: P >0.05, Significant: P ≤0.05*

Table 6: Correlation of BMI and waist circumference with different parameters among studied patients

Variable	BMI		Waist circumference	
	r	***P***	***r***	***P***
Age	0.047	0.11[1]	-0.176	0.08[1]
Waist circumference	0.393	**<0.001**[2]	-	-
FBG	0.293	**0.003**[1]	-0.164	0.33[1]
Cholesterol	0.285	**0.004**[1]	0.157	0.09
Triglycerides	0.343	**<0.001**[2]	0.347	**<0.001**[2]

Variable	BMI		Waist circumference	
	r	P	r	P
HDL	-0.286	**0.004**[2]	-0.062	0.54[2]
LDL	0.306	**0.002**[1]	0.092	0.37[1]
Syntax score	0.195	0.052[1]	0.296	**0.003**[1]

*[1]*Pearson correlation,* [2]*Spearman rank correlation test, Non-significant: P >0.05, Significant: P ≤0.05*

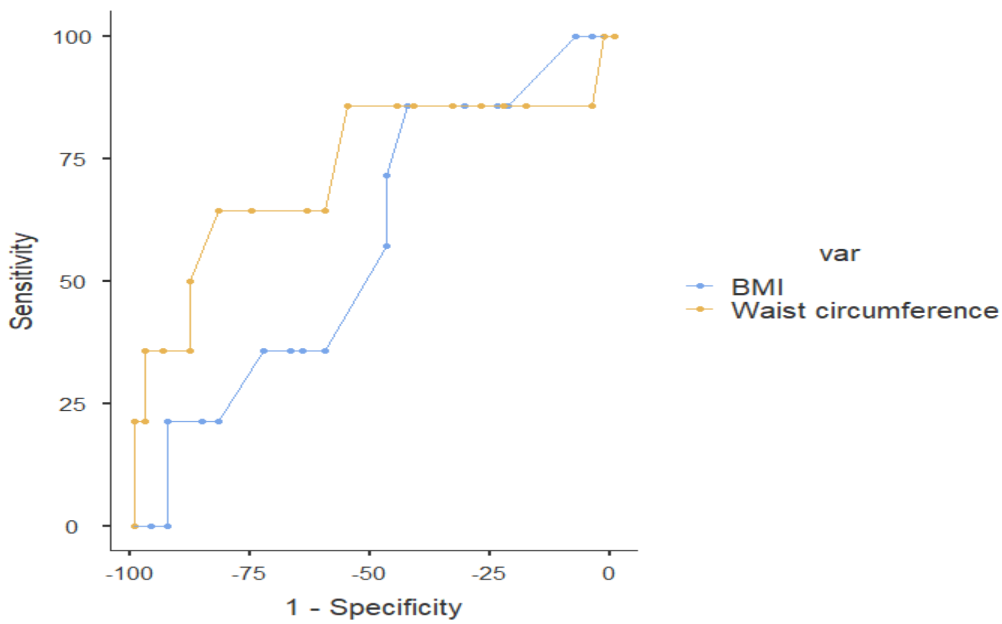

Figure (1): Roc curve analysis of BMI and waist circumference in detecting high syntax score among the studied patients

DISCUSSION

A statistically significant relationship between BMI and metabolic syndrome was shown by our analysis; patients with metabolic syndrome had a median BMI of (Mets) being higher (P=0.02). Additionally, BMI and dyslipidemia were statistically significantly correlated, with patients with dyslipidemia having a higher median BMI (P=0.01).

Our results also concurred with those of Ao et al. [21], who evaluated how MetS, with or without obesity, affected CABG patients' perioperative and postoperative results. They discovered that patients with MetS had a significant (p<0.0001) rise in BMI.

According to our research, those with a BMI below normal were less likely to acquire MetS than those with a normal BMI, whereas those who were overweight or obese had a 2.4 and 4.4 times higher risk of getting MetS, respectively [22].

In a study by Zheng et al. [23], logistic regression analysis also showed that a greater BMI was positively connected with a higher incidence of dyslipidemia in both males (OR = 1.287, 95% CI 1.210–1.368) and women (OR = 1.102, 95% CI 1.062–1.145).In both male and female participants, the results showed a largely linear relationship between BMI and the likelihood of dyslipidemia (P < 0.05).

This study was also in line with Nabati et al. [24], who looked at the connections between the degree of CAD and various anthropometric markers and obesity indices. Their results showed that men's mean SYNTAX score was higher than women's (9.29 ± 10.34 and 6.98 ± 9.97, respectively; P < 0.001). Additionally, DM and HTN rates were shown to be higher in patients with higher SYNTAX scores than in those with lower values.

In the current study, the syntax score and clinical data showed a statistically significant association; patients with metabolic syndrome, diabetes, hypertension, and dyslipidemia had higher median syntax scores (P<0.001).

The median waist circumference was higher among individuals with higher syntax scores (P=0.02), suggesting that the two variables have a statistically significant link. Additionally, there was a statistically significant correlation between the grades of the syntax score and metabolic syndrome; all patients (100%) with higher syntax scores had metabolic syndrome, compared to 53.8% of patients with lower syntax scores (P<0.001).

Another cross-sectional study that looks at the connection between coronary artery disease severity and body composition indices is similar to ours. Patients with severe coronary stenosis exhibited greater waist circumferences, waist/height ratios, and body roundness indices (BRI) than those without the condition, based on the SYNTAX and Gensini scores. Abdominal obesity is more atherogenic than peripheral obesity because the BMI remained same. [25].

A other cohort study by Rossi et al. [26] examined if there was a significant correlation between the degree of coronary atherosclerosis and BMI in 1299 patients who had underwent coronary angiography. The results were comparable to those in the current study. Compared to patients of normal weight, Diabetes mellitus, hypertension, and dyslipidemia were more common in obese individuals; nevertheless, a higher degree of coronary atherosclerosis did not significantly correlate with BMI.

This study, on the other hand, contrasted with Nabati et al. [24], who found a significant negative relationship between waist circumference and SYNTAX score, as participants with higher SYNTAX scores had lower waist circumference and BMI. A far bigger sample of 1008 patients who had coronary angiography was used in this investigation.

Our research revealed a significant negative correlation with HDL (r=-0.286, P=0.004), but a significant positive correlation with BMI and waist circumference (r=0.393, P<0.001), FBG (r=0.293, P=0.003), cholesterol (r=0.285, P=0.004), triglycerides (r=0.343, P<0.001), and LDL (r=0.306, P=0.002).

Furthermore, a large positive correlation was seen between the syntax score and (r=0.296, P=0.003) and waist circumference and triglycerides (r=0.347, P<0.001).

Our results are in line with another study that discovered a positive correlation between anthropometric characteristics in obesity and dyslipidemia. In obese groups, BMI, WC, and WHR (waist to hip ratio) showed a negative link with HDL and a positive correlation with TC, serum TGs, and LDL-C. WHR demonstrated a greater positive connection with all lipid measures than BMI, making it the strongest anthropometric variable in this investigation to predict dyslipidemia. [27].

Similarly, WC > 88 cm is linked to increased plasma TG and apo C-III concentrations as well as the existence of tiny, dense LDL particles, according to Lemos-Santos et al. [28]. Another notable characteristic linked to CAD and insulin resistance is small, dense LDL, which also puts people at risk for developing the metabolic syndrome. Therefore, WC is a reliable indicator of lipid profile.

Additionally, metabolically unhealthy obese patients have high triglyceride (TG) concentrations, low HDL-C concentrations, and near optimal or slightly elevated LDL-C concentrations, although the quantity of LDL particles can be increased, according to a study by Vekic et al. [29]. Accordingly, obese patients were found to have a favorable lipid profile in a sample of metabolically healthy individuals.

In order to identify the best cutoff value for identifying high syntax scores, we used Receiver Operation Curve (ROC) analysis. The results indicated that BMI had the maximum sensitivity (64.29%) and specificity (44.02%) at 34, with an area under the curve of 0.581.Additionally, measuring waist circumference using ROC analysis revealed that it had the maximum sensitivity

(85.71%) and specificity (82.56%) at 130, with an area under the curve of 0.732.

Furthermore, we discovered that waist circumference and BMI were both highly correlated with the risk of CAD in a study of middle-aged and older men and women conducted by Flint et al. [30]. But among men and women, WC predicts CAD risk more accurately than BMI. 60 years or more of age.

In a different study, Dimitriadis et al. [31] discovered that a high WC almost triples the incidence of CAD, separate from metabolic syndrome. Additionally, WC may indicate a stronger correlation between metabolic risks and the distribution of abdominal fat than BMI.

Contrary to our current findings, Paniagua et al. [32] and Gelber et al. [33] concluded that the BMI, WC, and other adiposity measures are not susceptible to identifying risk factors for cardiovascular disease.

According to our analysis, the median (IQR) for the syntax score was 5 (10), with a range of 0 to 33. Additionally, 78 percent of the patients had low syntax scores, 8 percent had intermediate scores, and 14 percent had high scores. Additionally, in terms of the number of vessels involved, 45% of the patients had no vessels involved, 12% had two vessels disease, 26% had one vessel illness, and 17% had three or more vessels disease. Regarding stenosed arteries, the LAD artery was involved in 46% of the patients, the diagonal artery in 10%, the LCX artery in 20%, the OM artery in 8%, the RCA in 20%, and the left major artery in 2% of the patients.

This study also concurred with Dung et al. [34], who showed that the population they studied had an overall mean SYNTAX score of 20.18 (SD=10.69), with a range of 2 to 49. The majority of lesions (55%), with low-score lesions (≤ 22) following in second (23–32) and third, respectively, for high-score lesions (> 32).

Our research indicates that there is no relationship between Syntax Score and BMI. A contradictory relationship between a lower burden and obesity of coronary atherosclerosis was discovered by Stalls et al. [35].

This was comparable to the findings of a research by Niraj et al. [36] that examined the association between CAD severity and BMI based on the SYNTAX score in a sample of 770 patients. A contradictory association was also reported by the authors. Most recently, Parsa et al. [37] revealed that, in a cross-sectional prospective examination of 414 individuals with suspected CAD receiving CA, there was a negative correlation between BMI and the severity of CAD.

In 928 CAD patients, Rubinshtein et al. [38] found a negative correlation between BMI and the severity of CAD. Younger and, paradoxically, less likely to have high-risk coronary architecture (≥50% stenosis of the left main coronary artery and/or severe 3-vessel coronary artery disease ≥70% narrowing) were obese patients who were recommended for CA.

According to Halima et al. [39], compared to the overweight and normal BMI groups, obese patients had a propensity for higher single-vessel involvement and needed shorter stents. The obese group had a lower Syntax Score, and the Syntax Score and BMI did not appear to be related (P = 0.388). BMI and Syntax Score II had a negative connection (P = 0.031).

In univariate analysis for variables related to the severity of CAD, Cepeda-Valery et al. [40] provided an example. Regardless of conventional CV risk factors, obesity was linked to a lower SYNTAX score (p = 0.009), fewer lesions >50% (p = 0.03), and less proximal LAD disease >50% (p = 0.02).

The proportion of vessels implicated in metabolic and non-metabolic obese individuals differed statistically significantly in our study; 63.2 percent of the non-metabolic obese patients had no involved vessels, compared to 33.9 percent of the metabolic obese patients (P=0.004). Additionally, compared to 7.9% of the non-metabolic obese individuals, 22.6% of the metabolic obese patients had three or more affected vessels (P=0.02).

Additionally, there was a statistically significant difference between patients who were metabolically obese and those who were not; the former had higher levels of HDL (P<0.001), while the latter had higher levels of cholesterol, triglycerides, fasting blood glucose, and syntax score (P<0.001).

Additionally, hypertension was seen in all metabolic obese individuals (100%) compared to non-metabolic obese patients (68.4%).

In line with our findings, a prior investigation into the impact of metabolic syndrome on angiographic severity in Egyptian patients suffering from acute coronary syndrome discovered that those with metabolic syndrome had noticeably greater rates of three-vessel disease and left main coronary artery disease, as well as a significantly higher Gensini score [41].

This study also supported the findings of Miri et al. [42], They aimed to ascertain whether A correlation was found between the severity of coronary artery disease (CAD) and metabolic syndrome (MetS). They showed that in contrast to those without MetS, patients with the illness had noticeably higher fasting blood sugar, triglycerides, cholesterol, and syntax scores. HDL levels were much lower in those with MetS, though.

Additionally, UPPUNDA et al. [43] examined the connection between body mass index (BMI) and metabolically obese (MO) status and the severity of angiographic CAD. Their results showed that CAD was more common in people with metabolic obesity than in those with higher BMIs. They came to the conclusion that, regardless of weight, the MO group had a greater prevalence and severity of CAD than the metabolically healthy group.

Additionally, a meta-analysis of observational studies on coronary artery disease and metabolic syndrome risk in Saudi Arabia was conducted. Should this meta-analysis prove to be accurate, Mets and its components are strongly linked to an increased risk of coronary artery disease and ought to be examined in order to confirm the prevalence of CAD [44].

Similarly, a research by Gao et al. [45] found that obesity itself has less of an adverse influence on the progression of coronary artery calcification (CAC) and CVD events as opposed to a profile that is metabolically unhealthy.The study showed that among obese individuals with metabolic disorders, a higher number of MetS components was associated with an increased chance of developing CAC.

According to a different study, obese individuals had a higher chance of developing severe coronary stenosis even in the absence of any other MetS criteria because higher BMI may contribute to the early development of coronary artery plaques. Compared to people of normal weight without MetS, this was observed in obese people without MetS. Coronary CT angiography (CCTA) was used to assess the severity of CAD in this trial, which had a larger sample size of 23,674 participants [46].

Additionally, a research by Timotoe et al. discovered that individuals with metabolic syndrome did not have a higher chance of developing severe coronary artery disease. which contradicts our findings. Increased triglycerides and glucose were the key metabolic syndrome factors linked to CAD, although abdominal obesity had a protective impact. They found that metabolic syndrome was not linked to CAD; only diabetes mellitus was. They explained this by making the assumption that, despite the fact that Mets is linked to a significant increase in the risk of CAD, its components confer varying degrees of independent risk, and that this variation in outcomes can be attributed to the predominant clusters of MetS components in various populations. The fact that 60% of patients in the Timoteo research were receiving lipid-lowering medication is another factor that could account for the disparity in the findings [47].

CONCLUSION

According to our research, a person's body mass index (BMI) is associated with low levels of HDL and high levels of FBG, cholesterol, triglycerides, and LDL. Triglycerides and Syntax Score (CAD severity) are correlated with waist circumference (central obesity). The maximum sensitivity (85.71%) and specificity (82.56%) for detecting high Syntax Score are seen in waist circumferences of ≥ 130 cm. Metabolic syndrome (MetS) is linked to elevated levels of FBG, cholesterol, and triglycerides and decreased HDL. Mets are also linked to a high Syntax Score, which gauges the severity of CAD.

Limitations: Our study's sample size was quite small due to its single-center design, which could have resulted in erroneous conclusions. Representativeness would be enhanced by include more healthcare facilities.

Recommendations: More research with a bigger sample size will yield more important findings. To validate our findings, more prospective randomized studies ought to be conducted.

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